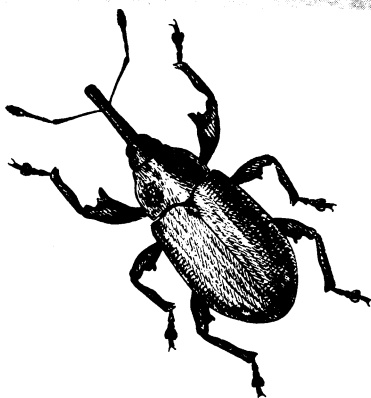


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the BOLL WEEVIL... how to control it



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CI 6524

Cover: Adult boll weevil; side and top views.

This edition replaces all previous editions of this publication. Because of changed insecticide recommendations, earlier copies are obsolete.

the BOLL WEEVIL... how to control it

The boll weevil¹ does more damage than any other cotton pest in this country. Since its entry into southern Texas in the 1890's, it has destroyed several billion dollars' worth of cotton.

This insect occurs in all the cotton-producing States except New Mexico, Arizona, Nevada, and California.

You can control the boll weevil by following good cultural practices and by applying insecticides. The use of insecticide should be considered supplemental to the essential cultural practices.

DEVELOPMENT

The boll weevil has four stages in its life cycle—egg, larva, pupa, and adult. Under favorable conditions, it completes the cycle in 2½ to 3 weeks. High temperatures and humidity speed the cycle; low temperatures slow down development. As many as seven generations may develop in a year in the extreme southern part of the Cotton Belt.

The adult boll weevil is ⅛ to ⅓ inch long. It ranges in color from tan

to dark gray, or sometimes to dark brown.

Starting in spring, the female lays eggs singly in cotton squares. When the boll weevil population is high and there is a shortage of squares, two or more eggs may be laid in one square. Late in the season, eggs are laid both in squares and in young bolls.

Eggs hatch in 3 to 5 days. The larvae feed 7 to 12 days inside the squares or bolls, then change into pupae. The pupal stage lasts 3 to 5 days. Adults develop from the pupae and cut their way out of the squares or bolls. After feeding 3 to 7 days, and mating, females begin laying eggs. The cycle is repeated until the cotton plants are killed by cold weather.

Adult boll weevils hibernate near cottonfields—in woods, along ditch banks, and in trash and litter around gins and farm buildings. In the spring they return to the cottonfields.

DAMAGE

By means of jaws at the end of its snout, an adult weevil eats into a square or boll. Two types of punctures result:

¹ *Anthonomus grandis*.



CI 6521

Cotton plant attacked by boll weevils: *A*, Hanging dry square, destroyed by weevil;
B, flared square, with weevil punctures.

Feeding punctures are made both by males and by females.

Egg punctures are made by females as places in which to lay eggs. They are deeper than feeding punctures.

Both types of punctures cause damage. After a square is punctured, the bracts around it flare; the square turns yellow and usually drops to the ground.

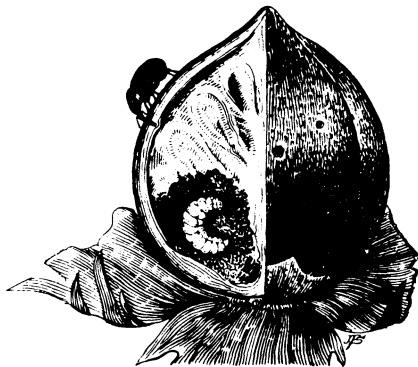
Many punctured small bolls drop to the ground. Punctured large bolls usually remain on the plant, but if they have egg punctures they will be damaged by the weevils developing in the locks where the eggs were laid. Weevil-infested locks produce no cotton or they produce a little that is of inferior quality.

CULTURAL PRACTICES

One of the aims of cultural control is to reduce to the minimum the number of boll weevils that survive after harvest and go into hibernation.

In areas where cotton can be harvested before frost, the best single way to carry out this aim is to destroy cotton stalks early in the fall—as long before frost as possible. If this is practicable in your area, plan early harvest and early destruction of stalks. Select a rapid-fruited, early-maturing variety of cotton that is suitable for your locality.

In areas where cotton must be harvested after frost, control of the boll weevil by destruction of stalks is not practicable. In these areas, comparable results can be obtained by using chemical defoliant and desiccants, which check plant growth and remove leaves and immature fruit.



CI 6521

Cotton boll, sectioned, showing attacking weevil, and weevil larva in its cell.

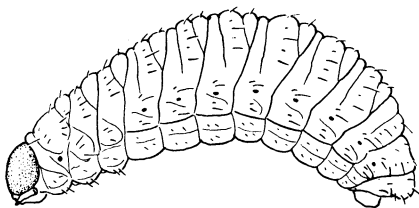
Anything you do to eliminate hibernation quarters will aid in control. Do these things:

- Practice clean cultivation.
- Plow ditch banks and turnrows in the fall.
- Remove weed clusters, particularly briars and vines, in pastures near cottonfields.
- Remove dense undergrowth from nearby woods. Follow forestry practices recommended by your district forester.
- Destroy litter around farm buildings.

Encourage neighboring growers to join with you in preventing hibernation of boll weevils.

Other cultural practices that aid in control are:

- Arranging for all growers in an area to start planting on approximately the same date.
- Planting the varieties of cotton that are recommended for your locality.
- Planting on land that is not adjacent to dense woods or other places favorable to hibernation.



Full-grown boll weevil larva (grub).

CONTROL WITH INSECTICIDES

Where cultural practices do not provide satisfactory control, insecticides are the only effective weapon against the boll weevil.

Seasonal Patterns

Generally, insecticide control of the boll weevil may be divided into the following patterns: (1) Early-season control of overwintered adults, and (2) mid- or late-season control of later generations. Both treatments may be required when overwintered boll weevils are numerous and weather conditions are favorable for weevil development.

Early-season control

In some areas, adults overwinter in numbers large enough to be a problem in most years. Here, early-season applications of insecticide may be used to kill as many overwintered boll weevils as possible before they destroy squares and before the females lay eggs to start a new generation. Treatments should be applied during the time when most of the weevils are returning to cottonfields from hibernation sites. Make the first application before the first squares are large enough for egg punctures; this will prevent reproduction from boll

weevils already in the fields. Since the weevils will continue to emerge from hibernation for several weeks, make about three additional applications at weekly intervals. Inspect the fields frequently thereafter, and repeat applications if you find damaging infestations.

Under some conditions, early-season control will protect the crop from serious injury until most of the bolls are set, and will result in earlier crop maturity. However, on highly productive soils in which fruiting occurs over a long period, late-season protection usually is needed. The early-season program is more effective if it is used on a community-wide basis.

Early-season control has special value in areas where droughts and plant diseases occur in the late summer and it is desirable to set the fruit as early in the season as possible.

Mid- or late-season control

Control of boll weevils after the main fruiting period begins is referred to as mid- or late-season control. Need for treatment is determined by making infestation counts. The recommended practice is to begin treatment when certain specified infestation levels are found. Square examinations are made at weekly intervals after plants are producing as many as three squares per plant. Insecticides are not applied until inspections show that the crop is actually being damaged or that threatening infestations are developing.

Making an infestation count.—In a field of 5 acres or less, determine the percentage of infestation as follows:

Walk diagonally across the field and pick 100 squares, one-third grown or larger. Pick squares equally from the

top, middle, and lower branches. Do not pick squares from the ground. Do not pick flared or dried-up squares that are hanging on the plant.

Count the number of squares that have boll weevil punctures. This number is the percentage of infestation.

If your field is larger than 5 acres, make additional counts—approximately one count for each 5 acres.

When to apply insecticide.—On soils in which cotton tends to set the crop early and cut out, start applications when 10 percent of the squares are punctured. On heavier soils in which the plants fruit over a longer period, and where potential production is high, start applications when 10 to 25 percent of the squares are punctured.

Repeat applications every 5 days until the infestation level drops below the recommended starting level, or until the crop is mature. When the boll weevil population is heavy, it may be necessary to reduce the interval between applications to 3 or 4 days. If an application is washed off by rain, repeat it as soon as possible.

Selecting Insecticides

Recommendations for selecting insecticides to control the boll weevil vary in different States. Every year, the Ex-

tension Service in each State issues a detailed guide for the control of cotton pests. You can obtain the guide from your county agricultural agent or State agricultural college. Follow it when you select insecticides.

The boll weevil has developed resistance to some insecticides in some areas. Your selection of an insecticide should be based on whether it has developed resistance in your area; if you are in doubt, consult your county agent. Generally, if control has been satisfactory with the insecticide you have been using, resistance to it has not developed.

Poor applications, rather than resistance, are often responsible for unsatisfactory control. Be sure that applications are made as recommended in your State guide. If you then fail to get control, ask your county agent for advice.

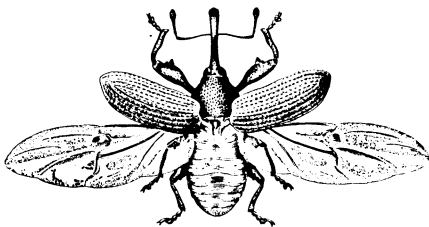
Where there is no resistance

If boll weevils in your area are not resistant to insecticides, use any of those listed in the table on page 9.

Where there is resistance

If boll weevils in your area are resistant to endrin, use one of the other insecticides listed in the table. If they are resistant to Strobane or toxaphene, you can add methyl parathion to the mixtures of toxaphene and DDT or Strobane and DDT for improved control.

When used for midseason or late-season control, any of the recommended insecticides that are not mixed with DDT—except Azodrin, endrin, and carbaryl—should have DDT added to help prevent buildup of bollworms.



CI 13809

Adult boll weevil with wings spread.

Applying Insecticides

Any insecticide in the table except Azodrin may be applied in either a dust or a spray.

Sprays or dusts may be applied with either ground machines or airplanes. Early-season applications are more effective when ground machines are used. Midseason or late-season applications are equally effective when made with ground machines or airplanes.

Rates of application suggested in the table cover a wide range to include amounts recommended by various States. Consult your State guide for amounts to use in your area.

Dusts

If you are applying dust with ground equipment, use one nozzle for each row; set nozzles 6 to 10 inches above tops of the plants.

If applying dust by airplane, limit the swath width to the plane's wingspan, or not more than 40 feet.

Dust applications usually are more effective if made in early morning or late afternoon.

Sprays

Spray materials for use on cotton are usually formulated as emulsifiable concentrates. When mixed with water, they form emulsions that are easily applied with ground machines or airplanes. Sprays of carbaryl are made from wettable powders; their application requires slight modifications in the equipment, such as the use of larger mesh screens in the line hoses and nozzles of sprayers generally used for cotton insect control.

When you use a ground machine, one properly adjusted nozzle per row

will put enough spray on plants in the presquare and early fruiting stages to give control. When the plants are larger, use two or three nozzles per row. These should be adjusted in such manner as to provide thorough coverage of the plants by the spray.

Before preparing a spray to be applied with a ground machine, you should know the per-acre discharge rate of the machine. This information enables you to mix the emulsifiable concentrate and water in the proper proportion. Example: If you are spraying with methyl parathion (2 pounds per gallon) for late-season control, and your machine has a discharge rate of 3 gallons per acre, you should add between 1 and 2 pints of methyl parathion concentrate to enough water to make 3 gallons total of spray per acre (see table).

Almost all cotton spraying is done with low-gallonage sprayers. The amount of spray dispensed is usually between 1 and 3 gallons per acre. However, on rank cotton, in late season, it may be necessary to increase the amount up to 5 gallons per acre to get the desired plant coverage.

Spray applied by airplane is usually mixed to have a higher percentage of actual insecticide than spray applied by a ground machine. The greater concentration reduces the total amount of spray that must be applied from the air, and thus reduces application cost. In many areas, only 1 gallon of spray is applied per acre. When plant growth becomes rank, however, 2 or 3 gallons per acre may be needed for adequate coverage. When applying spray by airplane, limit the swath width to the plane's wingspan.

Insecticide recommendations for controlling boll weevils

Insecticide	Formulation ¹	Pounds of active ingredient to apply per acre
Azinphosmethyl.....	D or EC.....	0.25 to 0.5.
Azodrin.....	Water soluble.....	0.6 to 0.75.
Carbaryl.....	D or WP.....	1.0 to 2.5.
Endrin.....	D or EC.....	0.2 to 0.5.
EPN.....	D or EC.....	0.5.
Malathion.....	D, EC, or LVC.....	1.0 to 2.0.
Methyl parathion.....	D or EC.....	0.25 to 0.5.
Methyl Trithion.....	D or EC.....	0.25 to 0.5.
Strobane+ DDT.....	D or EC.....	2.0 to 4.0+1.0 to 2.0.
Toxaphene+ DDT.....	D or EC.....	2.0 to 4.0+1.0 to 2.0.

¹ D=dust; EC=emulsifiable concentrate; LVC=low volume concentrate; WP=wettable powder.

PRECAUTIONS

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink

until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Azinphosmethyl, Azodrin, endrin, EPN, methyl parathion, and Methyl Trithion are highly toxic. Use adequate precautions in applying them.

Workers entering cottonfields within 5 days after plants have been treated with endrin, or on the day plants are treated with methyl parathion, should wear clean, tightly woven, protective clothing.

Do not graze livestock in cottonfields treated with Azodrin, DDT, endrin, Strobane, or Methyl Trithion or those treated late in the season with azinphosmethyl or toxaphene.

Minimum days to be allowed from last application to all types of harvest are 1 for azinphosmethyl, 21 for Azodrin, and 3 for EPN. Minimum days to hand harvest are 5 for both endrin and methyl parathion.

Do not apply Methyl Trithion after half the bolls are open.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

Do not assume that your cotton is free of other injurious insects because you are effectively controlling the boll weevil. Insecticide applications to control the boll weevil often create conditions favoring rapid increase of certain other cotton pests later.

The cotton aphid, for example, may cause serious damage following applications of mixtures of some chlorinated hydrocarbons. Spider mites are more likely to build up to damaging numbers following applications of carbaryl or the chlorinated hydrocarbons. The seriousness of the bollworm problem varies from year to year; often it becomes acute after applications of insecticides to control other cotton pests.

Inspect your field at least once a week. If you find that other pests are becoming more numerous, follow recommendations in your State guide. The Extension Service in each cotton-producing State issues this annual guide for controlling the boll weevil and other cotton insects. You can get a copy from your county agricultural agent. If you have questions concerning cotton insect control, consult your county agent.

The registrations for the use of Azodrin, endrin, methyl parathion, and Methyl Trithion on cotton were at the time of publication subject to cancellation January 1, 1970. Do not use any of these insecticides on cotton after January 1, 1970, without first determining whether the registration remains effective. Check with your county agricultural agent or with your State agricultural experiment station.



Use Pesticides Safely
FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE

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